

REMARKS

Claims 1, 3, 5, 7-9, 13, 16, 20, and 28 are pending in the present Application. Claim 1 has been amended, no claims have been added, Claims 4, 6, 10-12, 14, 15, and 21-27 have been canceled, and claims 4, 6, 10-12, 14, 15, and 21-27 remain withdrawn, leaving claims 1, 3, 5, 7-9, 13, and 28 for consideration upon entry of the present Amendment.

Amendments to Claims/Amendment after Final

Claim 1 has been amended to remove reference to alumina (Al_2O_3), support for which can be found in the examples in the Specification on p. 12 (Example 1), and on p. 15 (Example 3). No new matter has been entered by these amendments.

Claims 4, 6, 10-12, 14, 15, and 21-27 have been canceled per the Examiner's requirement under 37 C.F.R. 1.144.

As the above amendments only cancel existing matter from the claims, and where the amendments are intended to either place the claims in condition for allowance or better condition for appeal, and further as Claim 1 has only been narrowed such that further search should be unnecessary, Applicants respectfully request the Examiner kindly enter the above amendments to Claim 1 and cancellation of claims as amendments after final under 37 C.F.R. § 1.116, without need for filing a request for continued examination.

Reconsideration and allowance of the claims are respectfully requested in view of the above amendments and the following remarks.

Claim Rejections Under 35 U.S.C. § 103(a)

Claims 1, 3, 5, 7-9, 13, and 28 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over U.S. Patent Application Publication No. 2002/0114993 ("Miyaki") in view of U.S. Patent No. 5,916,485 ("Besenhard"). Applicants respectfully traverse the rejection.

Miyaki discloses a nonaqueous secondary battery containing a positive electrode and a negative electrode both containing a material capable of reversibly intercalating and disintercalating lithium, and wherein the positive and/or negative electrode have at least one protective layer thereon, a nonaqueous electrolyte, and a separator. Miyaki, Abstract.

Besenhard discloses a method for producing electrically conductive composites from predominantly non-conductive or poorly conductive substances through the application of substrate-induced coagulation. Besenhard, Abstract.

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, or knowledge generally available in the art at the time of the invention, must provide some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). “A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR Int’l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1741 (2007). To find obviousness, the Examiner must “identify a reason that would have prompted a person of ordinary skill in the art in the relevant field to combine the elements in the way the claimed new invention does.” *Id.*

Applicants wish to note the Examiner’s remarks which state that pointing out the differences between the references and each individual reference is not sufficient to overcome a rejection based on a combination of the references, and that one cannot show non-obviousness by attacking references individually where the rejections are based on combination of references. Applicants fully understand that the combination of Miyaki and Besenhard constitute the basis for the Examiner’s rejections, and wish to emphasize to the Examiner that the arguments made below and as made previously by Applicants are not intended to “attack the references individually” as stand-alone rejections, but are fully intended to show, by spelling out the differences between Miyaki and Besenhard, that the sum of limitations of the Examiner’s proposed combination of Miyaki in view of Besenhard fails to disclose all limitations of the instant claims, and further to show that neither reference provides a suggestion or incentive that would have motivated the skilled artisan to modify Miyaki with Besenhard to arrive at the invention claimed in instant Claim 1. See *In re Fine*, *Id.* Applicants further respectfully note that in all due fairness, the Examiner, in structuring his own arguments for the combination of Miyaki and Besenhard, also discusses each reference separately and individually for their respective elements, in separate paragraphs, and

ties these separate arguments together in a subsequent paragraph. See Final Office action, pp. 2-3. Applicants appreciate that one can only consider the elements of one reference at a time, even where the combination is the object of the argument. Applicants therefore, with the utmost respect due the Examiner, request that the Examiner please apply the same courtesy of understanding to the difficulties of expression faced by Applicants in rebutting the Examiner's rejections below, with the understanding that Applicants arguments made herein are directed to the sum combination of the references Miyaki in view of Besenhard.

The instant claims claim a method of producing surface modified materials, specifically surface modified cathode materials for lithium batteries. As argued previously, amended Claim 1 and its dependents are not obvious over Miyaki in view of Besenhard as the combination fails to teach all elements of the instant claims, and fails to provide a suggestion or incentive that would lead one skilled in the art to include the missing elements, with a reasonable expectation of success. Specifically, amended claim 1 requires "treating the resultant of step (ii) with heat at a temperature of more than about 550°C". Neither Miyaki nor Besenhard teaches or suggests this element. Furthermore, neither Miyaki nor Besenhard provides a suggestion or incentive that would lead one to include the above-described limitation in the combination of Miyaki and Besenhard, to apply the resulting method to TiO_2 as a coating material, and to LiCoO_2 as the bulk of material. Applicants therefore maintain that in view of the teachings of Miyaki and Besenhard alone, the method claimed in instant Claim 1 would not be accomplished.

The Examiner states that sintering step of Besenhard would produce the claimed gradient concentration and that the calcination step of Miyaki would produce the claimed limitation of core-shell material with different phases. Applicants respectfully disagree.

The concentration gradient between the bulk of material and the coating as provided by the method of instant Claim 1 is accomplished under a specifically controlled heat treatment condition, i.e., "treating the resultant of step (ii) with heat at a temperature of more than about 550°C". However, neither Miyaki nor Besenhard disclose or teach a heat treatment condition which will effect the concentration gradient of surface-modified material as claimed in the instant Claims, or as exemplified in instant Examples 1 and 3.

Specifically, the method of instant Claim 1 claims heating the resultant bulk material treated with a flocculant solution and dispersion, at a temperature of more than about 550°C to create a concentration gradient of one or more dopant or substituent element(s) from the surface to the bulk and/or core-shell materials with the core and the shell(s) being different distinct phases. A material having a concentration gradient of stoichiometry of one or more dopant or substitute element from the surface to the bulk as claimed in instant Claim 1 can be thereby be obtained by combining the substrate-induced coagulation (SIC) process with heat treatment. This combination of elements, and gradient feature, is not disclosed in Miyaki nor in Besenhard, and hence the combination of Miyaki in view of Besenhard fails to disclose this combination of elements.

As argued previously, Miyaki in view of Besenhard fails to disclose the heating treatment claimed in Claim 1 which involves heating the particulate solid particles deposited on the flocculant-treated bulk (referred to as the “deposit”, a material produced by steps (i) and (ii) of Claim 1) at a temperature of more than about 550°C, as required by the instant claims. As to the above combination, Miyaki discloses calcining to form the *amorphous composite oxides*, i.e., the negative electrode *bulk* material *absent* a protective layer, where the “calcining temperature is 500 to 1500°C for a calcining time of 1 to 100 hours”, there is no suggestion that this is applied, or even applicable to the bulk of material coated with a protective layer. Miyaki, paragraphs [0078] and [0079]. Likewise, the positive electrode material can be obtained by mixing a lithium compound and a transition metal compound followed by calcining at 250 to 2000°C; and the positive electrode active material may be washed *before* use. Miyaki, [0429], [0434]. There is thus no suggestion in Miyaki of applying a calcining step to a material other than a bulk of material *prior* to any formation of a protective layer. As to the formation of an inorganic insulating protective layer, Miyaki discloses only that it is undesirable that “the protective layer containing particles...melt or form another film at 300°C or less”, that while TiO₂ is considered “useful”, the insulating protective layer is formed by “using” the insulating particles in combination with a binder. Miyaki, [0013], [0018], and [0021]. As to the formation of the protective coating, Miyaki only discloses that the “protective layer can be formed successively or simultaneously by

applying an electrode material mixture containing a material capable of reversibly intercalating and deintercalating lithium onto a current collector”, but is otherwise silent as to any processing steps including thermal processing of the protective layer to form an interlayer gradient between the protective layer and the positive or negative electrode. Miyaki, [0059]. Miyaki thus clearly does not disclose high temperature heat treatment (calcining) of a flocculant particulate-coated bulk of material as claimed in Claim 1, but specifically discloses heat treatment of the bulk of material alone, tantamount to removing step (ii) of instant Claim 1 and hence fails to disclose or suggest any mechanism by which a gradient interlayer may be formed between the protective coating and the positive or negative electrode material. Besenhard is completely silent as to calcining at high temperature. Hence, the combination of Miyaki in view of Besenhard fails to teach or disclose a high temperature step (calcining) applied to the coated bulk of material, to provide a gradient of composition between the surface and the bulk, and fails to teach or suggest modifying the combination to include such a step.

Also in reference to its contribution to the combination of references, Besenhard discloses sintering. Col. 7, lines 27 and 40. However, sintering is provided in a context which indicates that it is merely a way to densify a conductive coating on a nonconductive substrate, a method having disadvantages which the substrate-induced coagulation of Besenhard overcomes; in fact, Besenhard teaches that sintering is unnecessary in this context (“the subsequent compacting process [e.g., sintering] can be dispensed with”) and thus apparently teaches away from sintering as a necessary step in conjunction with SIC. Col. 7, lines 22-30 and 36-41. Besenhard otherwise provides no definition of sintering, or the sintering process such as any particular temperature, and therefore this term does not adequately teach or disclose a high temperature process as claimed in Claim 1. Applicants note that, consistent with the densification of a film as implied by Besenhard, a common definition of “sintering”, such as that found in <http://metals.about.com/library/bldef-Sintering.htm>, supports this view, which it is stated that sintering is simply the “bonding of *adjacent surfaces* of particles in a mass of powder or a compact by heating”. This definition indicates that densification is the common object of sintering, but in no way suggests a

migration of materials or commingling of a substrate with a coating to form a gradient interlayer. In accordance with the above definition therefore, no more should be expected to result from a sintering step applied to a bulk of material coated with a particulate coating than a discrete, densified shell of the particulate with a sharp compositional boundary between the shell and the underlying bulk of material. Sintering thus cannot adequately describe or lead one to assume the formation of a commingled gradient, where the sintered particles by definition only meet at their adjacent surfaces. Furthermore, regarding Besenhard as applied to the combination of Miyaki in view of Besenhard, the closest teaching of Besenhard to a temperature that may be associated with a sintering step is found in the Examples, where a post-SIC thermal treatment of 210°C for 30 minutes is applied. Col. 9, lines 12-16; Col. 10, lines 5-9. This is significantly lower than that claimed in instant Claim 1.

Also, the Examiner has stated that sintering “would also produce the claimed gradient concentration” and identifies withdrawn Claim 11 as support. Final Office Action dated July 16, 2008, p. 5, first full paragraph. Applicants respectfully note and remind the Examiner that in the Restriction Requirement dated February 1, 2006, the Examiner required restriction between Claim 11, which discloses sintering (i.e., Claim 11), and heat treating to form a gradient (Claim 15 as originally filed, now included in Claim 1), as *patentably distinct species*, and that such election was made *without traverse*. Requirement for Restriction dated February 1, 2006, p. 2, section 1, first paragraph. Applicants note that the Examiner has therefore clearly distinguished between sintering and heat treating to form a gradient by regarding them as patentably distinct species, and cannot therefore now equate these processes as to do so would nullify the Examiner’s rationale for restriction. Further, in addition to the Examiner’s acknowledgement, and as evidenced by the teachings of Besenhard and the art above, sintering is discrete from the claimed heating step to form a gradient, and cannot in all fairness be equated to each other by the Examiner, notwithstanding the Examiner’s acknowledgement of the differences between these steps. To do so would constitute an impermissible hindsight, particularly in light of the Examiner’s previous acknowledgement that these steps are patentably distinct. Miyaki in view of Besenhard therefore does not provide a suggestion or incentive that a gradient would be expected by any heat treating

suggested in the combination or in the art by the term “sintering”.

With respect to the Examiner’s statement regarding a motivation to combine Besenhard with Miyaki, that while Besenhard suggests that “practically any materials can be coated in this way”, Besenhard further states that “the material of the substrate does not play a decisive role chemically in the coagulation process”, that “the only condition to be satisfied of the success of the process is a sufficient covering of the surface of the substrate with a coagulation trigger”, and that “this precondition can be met by water-soluble polymers on practically all substrates.” Besenhard, Col. 5, 11-20. Applicants do not dispute the general utility of SIC as a method; however, Applicants maintain that, based on the above disclosure of Besenhard and Miyaki, any combination of these nonetheless fails to teach, either generally or specifically, the application of a high-temperature heating step to a bulk of material that has been coated with an SIC-applied particulate coating, to form a gradient from the surface to the bulk, as claimed in instant Claim 1.

To summarize the above-detailed descriptions of the teachings of Miyaki and Besenhard with regard to their combination, Miyaki does not disclose or teach high temperature calcination treatment of a coated bulk of material, nor does Besenhard disclose or teach high temperature treatment of a particulate coated bulk of material, and specifically neither reference discloses high temperature treatment of a LiCoO_2 particle coated with TiO_2 to provide a gradient core-shell structure, as claimed in the instant claims. Hence, the *combination* of Miyaki in view of Besenhard fails to teach all elements of the instant claims.

It will also be appreciated therefore that, absent a further modification of the combination of Miyaki in view of Besenhard, a gradient between the coating and the bulk of material, as claimed in instant claim 1, cannot be achieved by application of a combination of the methods of Miyaki in view of Besenhard. Particularly where neither reference provides a suggestion that “sintering” encompasses a process that would result in the formation of a gradient layer in defiance of the plain meaning of the term found in the art and as acknowledged by Besenhard, Miyaki in view of Besenhard fails to provide a suggestion or incentive that would lead one skilled in the art to include a calcination step with the coated bulk of material expressly to form such a layer. As argued previously, “core-shell” materials

with the core and the shell being different phases can only be formed at a temperature of more than about 550°C, because a chemical reaction between the bulk material and the deposit to form one or more new phases can only happen at 550°C or higher. See Specification, p. 7, lines 20-24; p. 11, lines 14-16.

Therefore, amended Claim 1 is not unpatentable over Miyaki in view of Besenhard since the combination fails to disclose or suggest all elements required by the present claims. Claims 3, 5, 7-9, 13, and 28 each depend directly or indirectly from Claim 1 and therefore are also not unpatentable over the combination of cited references, and should be allowable. Reconsideration and withdrawal of the rejections, and allowance of the claims, are respectfully requested.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance are requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

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